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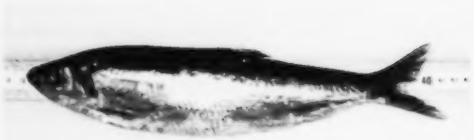
Canadian Science Advisory Secretariat
Science Advisory Report 2010/032

ASSESSMENT OF THE WEST COAST OF NEWFOUNDLAND (DIVISION 4R) HERRING STOCKS IN 2009



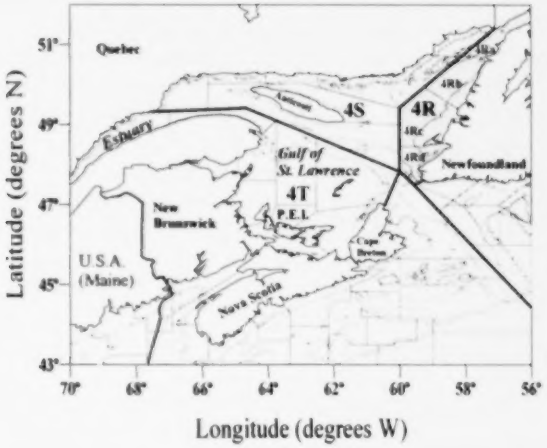


Figure 1. Map of unit areas of NAFO Division 4R (west coast of Newfoundland). Division 4R is identified by the coloured area.

Context

Herring are a pelagic species that perform over the course of a year significant migrations associated with spawning, feeding and wintering. Herring are part of a commercial fishery and in Canadian waters, the main fishing areas are south-western Nova Scotia and the Bay of Fundy (complex of stock 4VWX), the southern Gulf of St. Lawrence (4TVn stocks) and the west coasts (4R stocks), east and south-east (3KLPs stocks) of Newfoundland. On the west coast of Newfoundland (NAFO Division 4R) (Figure 1), the average annual landings of herring have been about 16,000 t since 1990. The main gear is the purse seine with average annual landings of 14,000 t. The purse seine is followed by the "tuck" seine (modified bar seine) and the trap.

The west coast of Newfoundland herring fishery is managed by a Total Allowable Catch (TAC) associated with both spawning stocks. The current TAC of 20,000 t was set during the last analytical assessments. The TAC split between the various fleets is as follows: 55% for large seiners (> 65 '), 22% for small seiners (<65') and 23% for fixed gear.

A first series of biannual acoustic surveys was conducted between 1991 and 2002. A second series of surveys begun in the fall of 2009 following the recommendations from the Fisheries Resource Conservation Council (FRCC). In a few years time, this series will allow for the return of an analytical assessment as well as the updating of biological reference points. They will help develop a strategic framework for fisheries consistent with the precautionary approach. This framework aims to reduce the risk of serious or irreversible damage to commercially exploited stocks.

The last assessment of the two herring spawning stocks in 4R was in 2005. The Fisheries and Aquaculture Management Branch has requested a scientific advice on these stocks for the 2010 and 2011 fishing seasons. At a meeting held on May 4, 2010, a review of the status of these stocks was made. This paper presents the results and conclusions of this meeting.

June 2010

Canada

SUMMARY

- In 2009, herring catches from the west coast of Newfoundland (NAFO Division 4R) totalled 20,236 t for a TAC of 20,000 t. For the second consecutive year, allocations for all fishing fleets were reached. Catches from the bait fishery are not recorded and could be very significant.

- The most significant herring catches have been made using the purse seine in unit areas 4Rc and 4Rb. Catches from large (>65') and small (<65') seiners respectively totalled 11,170 t and 4,415 t compared to annual averages (2000-2007) of 10,052 t and 3,223 t.

- A new fishing gear used since 2005, the "tuck" seine, caught 3,779 tons of herring in 2009. The "tuck" seine is a modified bar seine and is considered a fixed gear.

- A first series of biennial acoustic surveys took place between 1991 and 2002. A new survey series began in the fall of 2009. The total biomass index of fall-spawning herring assessed by this survey was similar to that measured in 2002.

- According to the acoustic survey, the total biomass index of spring-spawning herring continued declining to 6,000 t in 2009. In 2002, spring herring accounted for 32% of the combined biomass of the two spawning stocks compared to 8% in 2009.

- The abundance of the spring component continued to decrease even though management measures have been introduced since 1999 to protect this stock's spawning activities. Considering the lack of reconstruction of the reproductive component, it is recommended to maintain these management measures.

- Catches are now made up in large part of fall-spawning herring. In recent years, catches of about 20,000 t have been supported by a strong year-class. It is unlikely that this type of catch level can be sustained without the occurrence of a strong recruitment.

- It is recommended to disperse fishing effort along the coast and throughout the year to promote the conservation of the two herring spawning stocks on the west coast of Newfoundland.

- It is recommended that the bait fishery be closely monitored in order to estimate catches.

- Without abundant recruitment, the current catch level (20,000 t) should not be increased in 2010 and 2011. The 2010 acoustic survey should clarify the status of both reproductive components.

INTRODUCTION

Species Biology

Atlantic herring (*Clupea harengus harengus*) is a pelagic fish that frequents cold Atlantic waters. Its distribution in Canada extends from the coasts of Nova Scotia to the coasts of Labrador. It travels in tight schools in order to feed, to spawn near the coast and to overwinter in deeper waters. The same herring return to the same spawning, feeding and wintering sites year after year. This homing phenomenon is attributed to a learning behaviour with the recruitment of young year-classes in a population. At spawning, eggs attach themselves to the sea floor, forming a carpet of a few centimetres thick. The egg incubation time and larval growth are linked to ambient environmental characteristics such as water temperature. Most herring reach sexual maturity at four years of age, at a length of about 25 cm. Compared with other herring populations, the west coast of Newfoundland herring are characterized by two spawning stocks. Spring herring generally spawn in April and May, and fall herring in August and September.

ANALYSIS

The 2009 Fishery

Herring landings on the west coast of Newfoundland have been rising since 1999 (Figure 2). In 2009, they totalled 20,236 t compared with 20,742 t in 2008, and with an annual average (2000-2007) of 15,204 t (Table 1). A total of 10,707 t were caught in unit area 4Rc, compared with 4,574 t, 4,134 t and 821 t for unit areas 4Rb, 4Rd and 4Ra (Table 1).

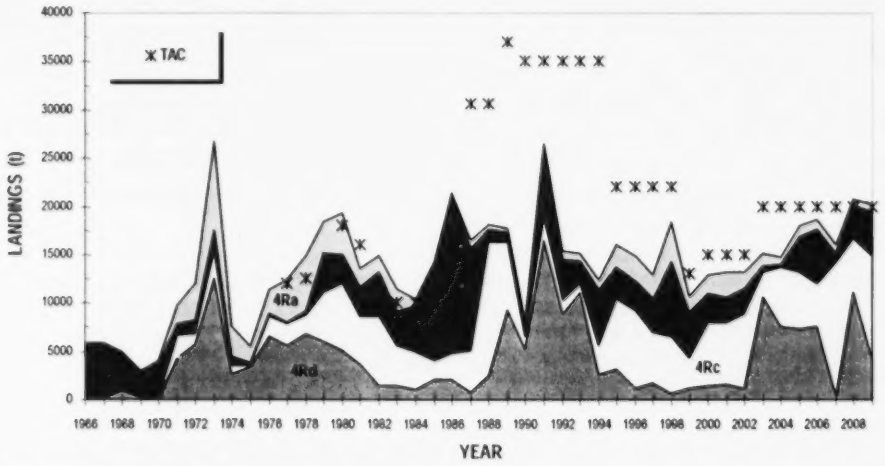


Figure 2. Herring cumulative commercial landings (t) and TACs (t) for unit areas of NAFO Division 4R, 1966 to 2009.

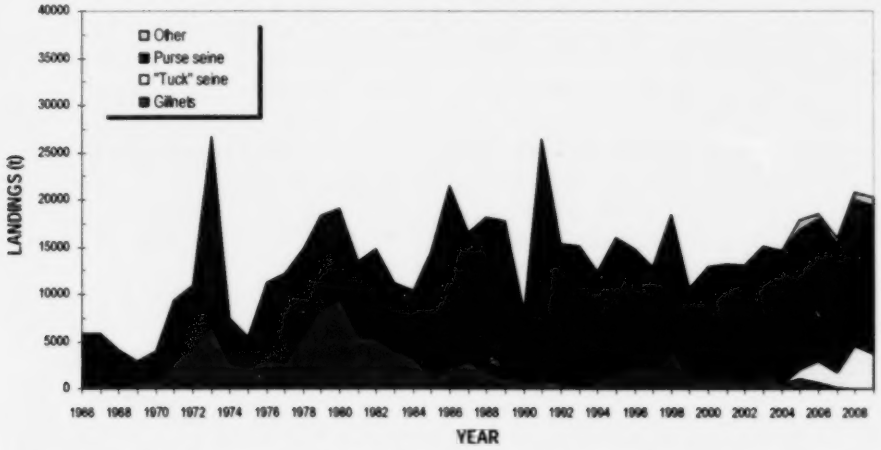


Figure 3. Herring cumulative commercial landings (t) per fishing gear for NAFO Division 4R, 1966 to 2009.

Table 1. Annual herring catches (t) in the unit areas on the west coast of Newfoundland, NAFO Division 4R.

UNIT	AVERAGE		YEAR										AVERAGE
AREA	(1990-1994)	(1995-1999)	2000	2001	2002	2003	2004	2005	2006	2007	2008*	2009*	(2000-2007)
4Ra	745	2 644	1 981	2 613	1 604	1 290	712	1 137	955	884	731	821	1 397
4Rb	4 071	4 434	2 995	2 643	2 621	714	252	3 574	5 646	915	3 286	4 574	2 420
4Rc	1 845	5 954	6 469	6 379	7 660	2 593	6 162	5 889	4 457	13 860	5 668	10 707	6 684
4Rd	8 827	1 539	1 470	1 589	1 232	10 533	7 574	7 326	7 524	375	11 058	4 134	4 703
Unknown	1 824	0	0	0	0	0	0	0	0	0	0	0	0
TAC			*15 000*	*15 000*	*15 000*	*20 000*	*20 000*	*20 000*	*20 000*	*20 000*	*20 000*	*20 000*	
TOTAL			12 916	13 224	13 117	15 131	14 700	17 927	18 583	16 034	20 742	20 236	15 204

* Preliminary data

On the west coast of Newfoundland, most herring landings are associated with the purse seine (Figure 3). In 2009, landings by large seiners (>65') totalled 11,170 t compared with 4,415 t by small seiners (<65'), 3,779 t by the "*tuck*" seine and 872 t by trap (Table 2). The "*tuck*" seine, which is a modified bar seine, has been used in the herring fishery since 2005. It is considered a fixed gear. For the second consecutive year, all fishing fleets reached their respective allocations (Figure 4). Between 1990 and 2004, gillnets took on average only 30% of their allocation. The arrival of the "*tuck*" seine in this fishing fleet increased the average for the 2005-2009 period to 81%.

Table 2. Annual herring catches (t) for the main fishing gear used on the west coast of Newfoundland, NAFO Division 4R.

FISHING	AVERAGE		YEAR										AVERAGE
GEAR	(1990-1994)	(1995-1999)	2000	2001	2002	2003	2004	2005	2006	2007	2008*	2009*	(2000-2007)
Gillnet	611	2 145	1 277	1 215	1 256	1 629	499	1 031	703	132	3	0	968
"Tuck" seine	0	0	0	0	0	0	0	909	2 286	1 545	4 498	3 779	593
Other seine	1	0	0	96	13	2	2	530	8	8 05	0	0	82
Trap	115	185	59	150	73	104	127	528	498	706	700	872	281
Small seiner (<65')	3 914	3 310	3 153	3 418	3 383	2 307	2 973	3 918	3 942	2 688	4 357	4 415	3 223
Large seiner (>65')	12 671	8 931	8 427	8 344	8 392	11 090	11 099	11 006	11 102	10 954	11 184	11 170	10 052
Other	0	2	0	0	0	0	0	5	0	0	0	0	1
TOTAL			12 916	13 224	13 117	15 132	14 700	17 927	18 538	16 034	20 742	20 236	

* Preliminary data

In 2009, catches by large seiners were mostly made in 4Rc and catches by small seiners in 4Rc and 4Rd (Figure 5). The "*tuck*" seine was used mainly in 4Rb compared to the trap in 4Ra. The herring purse seine and "*tuck*" seine fishery is practiced mainly in the fall. Spring fishing activities were strongly reduced following the implementation of management measures to protect the spawn of spring-spawning herring. In the fall, the herring fishery follows the mackerel fishery. The allocation of large seiners is reached within a short period.

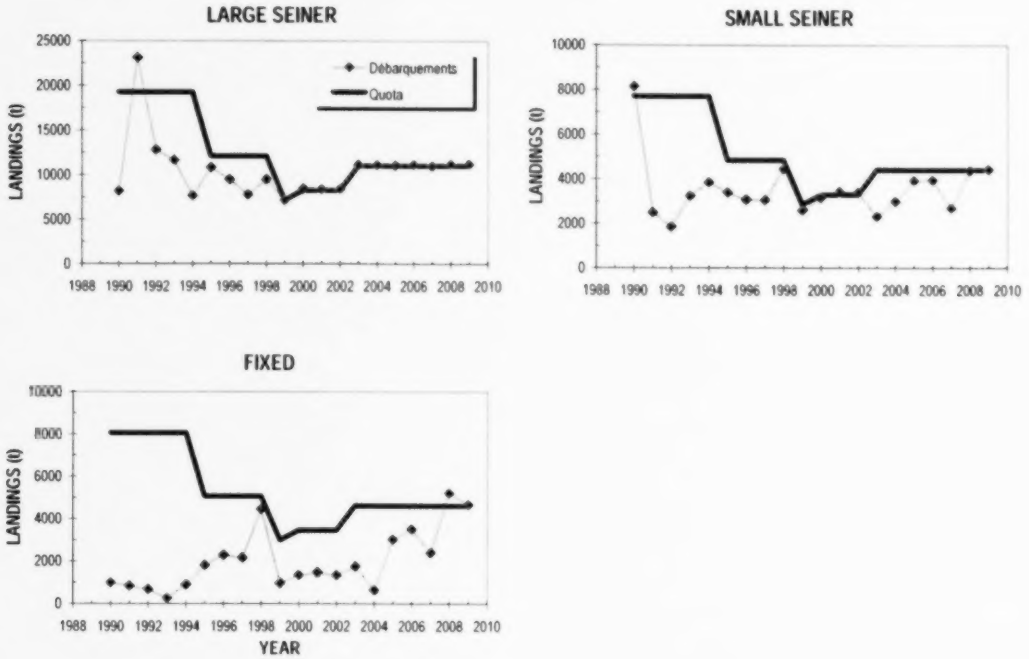


Figure 4. Annual landings (t) and allocations (t) for each herring fishing fleet of the west coast of Newfoundland, NAFO Division 4R.

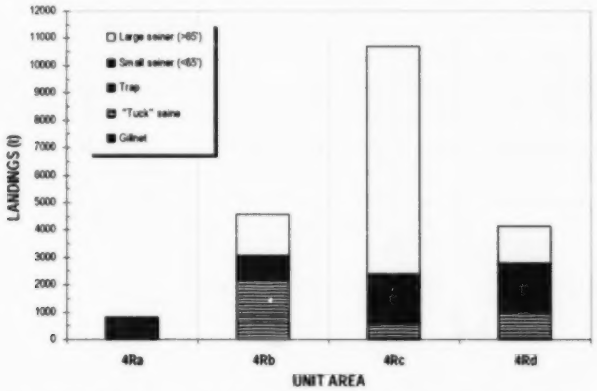


Figure 5. Herring landings (t) in 2009 per fishing gear for unit areas of the west coast of Newfoundland, NAFO Division 4R.

Biological Data

A new otolith reader has been in place for the last few months. Training is ongoing and exchanges are taking place with the Moncton laboratory. After the training period has ended, the analysis of biological data will be completed.

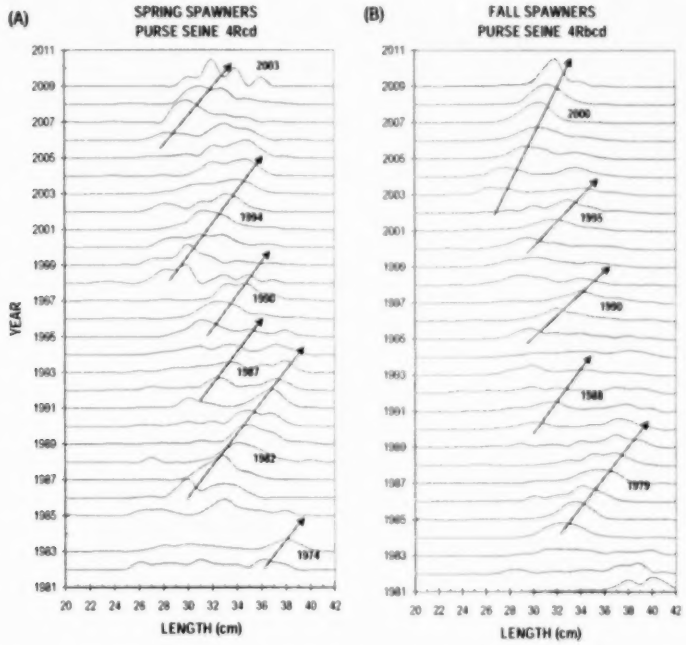


Figure 6. Annual length (cm) frequencies (%) of spring (A) and fall (B) spawning herring caught in the fall with the purse seine in unit areas 4Rbcd since 1981 (some year-classes are indicated).

For now, length frequency analysis indicates that the spring component is characterized by the occurrence of a few year-classes (Figure 6A). However, the fall component has been strongly dominated for several years by a single year-class whose exact year of birth will be confirmed when age readings have resumed (Figure 6B).

Resource Status

Acoustic Survey

A first series of biennial acoustic surveys took place between 1991 and 2002. A second series of surveys started in the fall of 2009 following the recommendations from the FRCC. The first surveys from this new series should be conducted on an annual basis to enable the fastest possible return of an analytical assessment as well as the updating of biological reference points.

The 2009 acoustic survey took place between October 18 and November 9. Quebec's Lower North Shore was covered first, followed by unit areas 4Ra and 4Rb. These areas correspond to strata 9 and 10 (Figure 7).

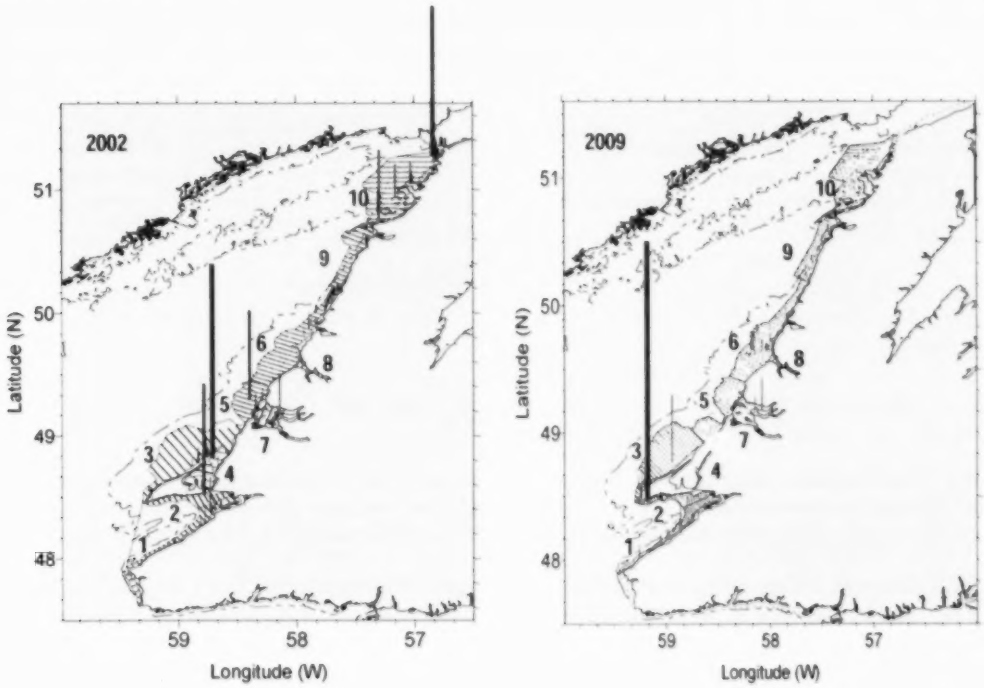


Figure 7. Herring density distribution (kg/m^2) along the west coast of Newfoundland in the fall of 2002 and 2009 (completed strata and transect numbers are indicated; scale densities expressed by the height of the bars differ from one survey to the other).

Unlike the survey conducted in the fall of 2002, no significant signal was measured in 2009 in strata 9 and 10. The most significant signals, expressed in herring density (kg/m^2), were measured in strata 1 and 2 (St. Georges Bay) and strata 6 (off Bonne Bay) and 7 (Bay of Islands).

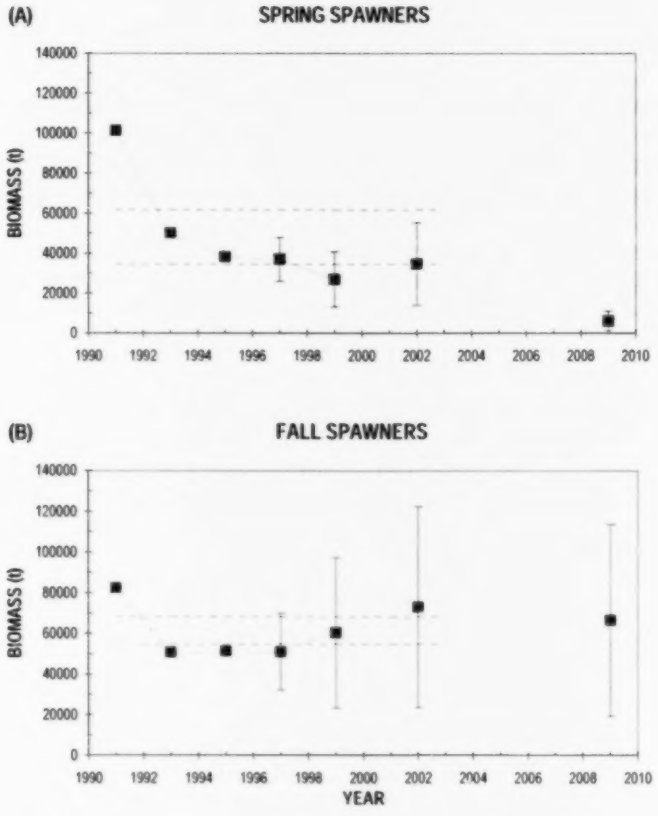


Figure 8. Total biomass index (t) (with 95% confidence intervals for the last four surveys) of spring (A) and fall (B) herring spawning stocks of the west coast of Newfoundland (NAFO Division 4R) estimated by the acoustic survey. The horizontal lines represent the 1991-2002 average ± 0.5 x standard deviation.

The total biomass index of spring-spawning herring continued to fall from 34,372 t in 2002 to 5,986 t in 2009 (Figure 8A). In 2002, spring herring accounted for 32.1% of the total biomass of the two spawning stocks compared to 8.3% in 2009 (Figure 9). The mean size of herring used to calculate the biomass index was 335.0 mm in 2002 compared to 328.3 mm in 2009 (Figure 10A).

The total biomass index of fall-spawning herring was estimated in 2009 at 66,404 t compared to 72,916 t in 2002 (Figure 8B). The mean size of herring used to calculate the biomass index was 328.8 mm in 2002 compared to 326.3 mm in 2009 (Figure 10B).

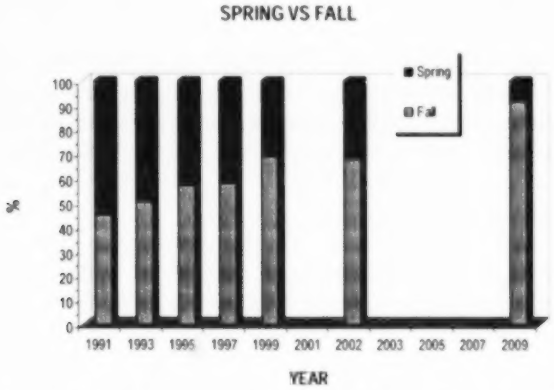


Figure 9. Percentage of spring and fall spawning herring observed in the biological samples used to calculate the biomass indices from the acoustic survey results.

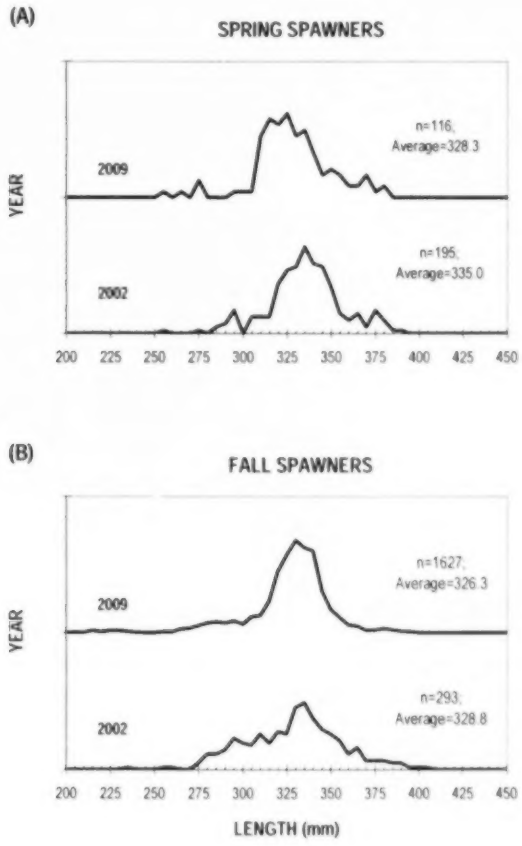


Figure 10. Length frequencies (mm) of spring (A) and fall (B) spawning herring used to calculate biomass indices from the acoustic survey results.

Analytical Assessment

The acoustic survey will allow in a few years the return of a complete analytical assessment. This type of assessment may be conducted as soon as we obtain the data from a minimum of four surveys. The analytical assessment will provide an update of the biological reference points and will help develop a strategic fishery framework consistent with the precautionary approach.

Sources of Uncertainty

The main source of uncertainty is the lack of statistics related to the gillnet bait fishery. There are currently more than 300 licenses for bait in St. Georges Bay, Port au Port Bay and Bay of Islands. The bait fishery is practiced during the lobster fishery and therefore targets spring spawning herring whose abundance has been decreasing.

CONCLUSION AND ADVICE

The 2009 fall acoustic survey confirms the decrease in abundance of the spring herring component. With the absence of reconstruction signs, it is recommended that the management measures in place to protect the spawn of this spawning component remain in place. It is further recommended that the spring bait fishery which specifically targets this component be close monitored (log-books) in order to estimate catches.

The acoustic survey results indicate that the abundance of the fall component decreased slightly between 2002 and 2009. Current catches consist overwhelmingly of fall spawning herring. In recent years, catches of about 20,000 t have been supported by a strong year-class. It is unlikely that this catch level can be sustained without a strong recruitment.

The dispersal of fishing effort along the coast and throughout the year is recommended in order to support the conservation of the two herring spawning stocks of the west coast of Newfoundland.

Without abundant recruitment, the current catch level (20,000 t) should not be increased for 2010 and 2011. The 2010 acoustic survey should confirm the status of the two spawning components.

SOURCES OF INFORMATION

Beaulieu, J.-L., I. H. McQuinn and F. Grégoire. 2010. Atlantic herring (*Clupea harengus harengus* L.) on the west coast of Newfoundland (NAFO Division 4R) in 2009. DFO Can. Sci. Advis. Sec. Res. Doc. 2010/049.

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